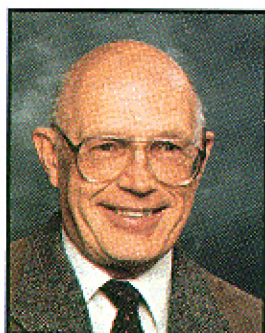


How to handle (and some cases of) forward and reverse orbits



by **Don Bently**

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The classical response of a rotor system is a circular and forward (in the direction of rotation) orbit. For many reasons, however, the orbit may be elliptical or flat, or even reverse elliptical or a reverse circle. The simplest and predominant reason for such orbits (but by no means exclusive) is nonsymmetric (anisotropic) support stiffness of the rotor system.

The asymmetry could be in the bearing (such as more horizontal than vertical clearance, or by vertical steady side load), or it could be in the support structure of the bearing. Typically, most horizontal machines are weaker horizontally than vertically for all three reasons noted herein.

Here is a very simple rotor system (Figure 1) with a horizontal bearing stiffness much lower than the vertical bearing stiffness. Figure 2 shows the Bode plots of rotative speed vertical and horizontal dynamic motion (vibration) behaviors. The phase angle portion of the Bode plot makes the description of

the forward and reverse orbiting very simple and straightforward. As you may observe, the rotor vibrates in reverse in the period between the two resonances. The orbits for various speeds are also

shown on the figure.

Next, observe the polar plots of this same rotor (Figure 3). Note that the polar plots for the vertical and horizontal are grossly different from the polar plots

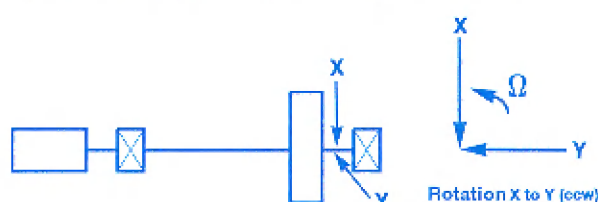


Figure 1

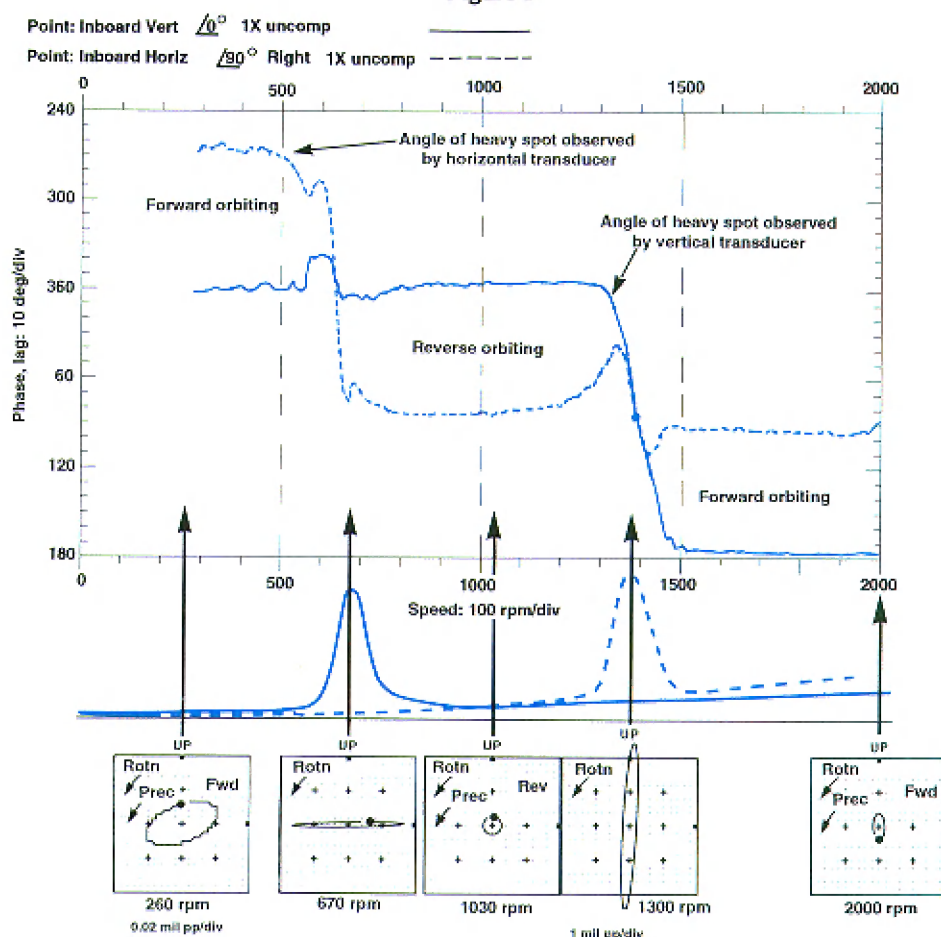


Figure 2

b) in a polar plot, an internal loop, then, to read the machine behavior properly, you must coordinate rotate the

Of course, this rotation of the probe angle does not work for two different lateral balance resonance modes, except to yield the angle between the unbalances for each mode, which is about useless. Be sure to remember that, while the

Editor's note: Bently Nevada has a new convention for indicating shaft rotation direction. Please see X to Y and Y to X on page 27.

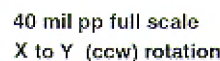


Figure 3